What range of contaminants have been observed and how do these levels compare with health-based benchmarks?

A comparison of inorganic against health –based benchmarks is outlined in the Table 1 below. A comparison of organics against health-based benchmarks is provided in Table 2. Table 3 provides some comparison across the range of residential results for baseline (pre-drilling) sampling and post-drilling sampling. The consistent trend for all parameters is that contaminant levels increased, in many cases by orders of magnitude.

Table 1
"Post-Drilling" Well Contaminant Summary
Residential Wells Showing Elevated Hazard Quotients or Excess Cancer Risk

Wells	Contaminants (ug/L) and Hazard Quotients/Excess Cancer Risks							
	Aluminum	HQ	Iron	HQ	Manganese	HQ	Arsenic	HQ / Cancer Risk
Ex. 6 - Personal Privacy	6050	<1	3390	<1	361	1.1	3.1	<1
	3140	<1	4517	<1	628	2.0	<1	<1
	4698	<1	15500	1.4	413	1.3	37	7.9 8.2×10^{-4}
	3290	<1	24100	2.2	669	2.1	6.5	1.4 1.4×10^{-4}
	3610	<1	16060	1.5	374	1.2	3.3	<1
	44100	2.8	18700	1.7	1920	6.0	25	5.3 5.6×10^{-4}

All six of these wells, and two additional wells, also had increased chloride levels in the post-drilling sampling results. The chloride values ranged from 5380 to 156,800 ug/L.

Contaminant Reference Values (ug/L)

Contaminant	**Regional Screening Level Hazard Quotient = 1**	**Regional Screening Level Hazard Quotient = 3**	**Regional Screening Level Excess Cancer Risk = 1×10^{-4}**
Aluminum	16,000	48,000	
Iron	11,000	33,000	
Manganese	320	960	
Arsenic	4.7	14.1	4.5

Note: The "Hazard Quotient" is the ratio of the exposure to the substance and the level at which no adverse effects are expected. If the HQ is equal to or less than 1, then no adverse health effects are expected as a result of exposure. If the HQ is greater than 1, then adverse health effects are possible.

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Table 2
"Post-Drilling" Summary of Maximum Organics Concentrations in Residential Wells (ug/L)
Comparison to Regional Screening Levels (RSL), with Hazard Quotients (HQ) and Excess Cancer Risks

Contaminant	RSL HQ = 1	RSL HQ = 3	RSL Cancer Risk = $1x10^{-4}$	Max Concentration	HQ	Excess Cancer Risk
Butylbenzyl phthalate	1230	3690	1400	0.54	0.0004	3.9×10^{-8}
Di-n-butyl phthalate	670	2010		0.87	0.001	
Triethylene Glycol*	2669	8007		4000	1.5	
2,2'-Oxybisethanol				3600		
Diethylphthalate	11,000	33000		0.2	0.00002	
GRO (C6-C10)				17		
Bis(2-ethylhexyl) phthalate	313	939	7.1	22	0.07	$3.1x10^{-4}$
2-Methylnaphthalene	27	81		0.022	0.0008	
Naphthalene	6.1	18.3	14	0.37	0.06	2.6×10^{-6}
Phenanthrene		0		0.048		
1-Methylnaphthalene	461	1383	97	0.025	0.00005	2.6×10^{-8}
Ethylene Glycol	31,000	93000		1600	0.05	
2-Methoxyethanol	78	234		1500	19	
Acetone	12,000	36000		4.2	0.0004	
Acenaphthene	400	1200		0.03	0.00008	

*This result has a JB qualifier attached to it. "B" qualifiers generally imply the presence of blank contamination, which would make this data point invalid. Additionally, the RSL for this compound is provisionally derived, based on the oral LD50 value for triethylene glycol in rats multiplied by an uncertainty value of $1x10^{-5}$.

Based on this summary, three contaminants exceed screening levels: Bis(2-ethylhexyl) phthalate, with an excess cancer risk of $3.1x10^{-4}$, 2-Methoxyethanol, with an HQ of 19, and Triethylene Glycol, with an HQ of 1.5.

Table 3
"Pre- and Post-Drilling" Contaminant Ranges in Residential Wells

Contaminant	Pre-Drilling Range (ug/L)	Post-Drilling Range (ug/L)
Aluminum	ND - 55	31.4 - 6050
Chloride	<2000 – 12700	5380 – 156,800
Iron	<5 - 390	273 – 24,100
Magnesium	ND – 6500	1550 – 125,600
Manganese	ND – 28	84 – 1920
Methane	ND	3610 – 294,000
Ethane	ND	77 - 2060
Propane	ND	0.17 - 98
Iso -Butane	ND	.37 – 1.7
n-Butane	ND	1 – 6.3
Ethene	ND	ND – 58.6
Arsenic	4.3	<1 - 37

Some are NS

CH_4 10 mg/kg.